IECC 2003 SUMMARY
Commercial Buildings Only

This summary is based on requirements of the International Code Council's 2003 International Energy Conservation Code, which is based in turn on the requirements of the American Society of Heating Refrigerating and Air-Conditioning Engineers / Illuminating Engineering Society of North America Standard 90.1-2001. Standard 90.1 forms the basis for both the International Code Council (replacement of ICBO, SBCCI and BOCA) and NFPA energy codes. While most local code entities in Colorado currently use the old ICBO's Uniform Building Code, the ICC series has now replaced this publication. Future code upgrades in Colorado communities are expected to reflect the International codes, which include the International Energy Conservation Code. The 2003 IECC represents the latest in suggested minimum energy conservation requirements, replacing earlier codes such as Colorado's 1997 "Energy Guidelines"

Code values are minimum requirements, so the energy code represents the least efficient building you are permitted to construct. Below in the sections on lighting and mechanical systems are some suggested values that represent a slightly higher level of efficiency, and come from a variety of sources including the government *ENERGY STAR*tm program and anticipated future requirements by the committee responsible for the development of Standard 90.1. Supplemental materials, such as illuminance levels, were derived from the 9th Edition IESNA Lighting Handbook.

A computerized tool for verifying compliance with minimum code requirements is "COMCheck-EZ", developed by a grant from the Department of Energy and available by free download from the www.energycodes.gov web site. It is highly recommended that all designs be verified to meet minimum code requirements through this program using the 2003 IEC selection.

Architects, Engineers and others involved in building design should be encouraged to use the codes, handbooks, and sources of this material directly, as the summary presented here represents only a subset of the material. Useful web sites include:

www.internationalcodecouncil.org
www.energycodes.gov
www.ashrae.org
www.iesna.org
www.energystar.gov
www.e-star.com

Comments and Suggestions on Building Design

- The requirements summarized here are minimums and do not necessarily represent optimum design. Innovation, integration of the individual pieces of the building and checking the results through modeling can result in buildings that use significantly less energy while maintaining the structure's primary function to provide shelter and comfort.
- Consider building and glazing orientation in initial design. Excessive west facing glazing combined with afternoon sun will result in heavy cooling loads during the peak building energy use time of the day, resulting in higher utility bills.
- Day lighting is desirable but must be controlled. While some European codes now require occupants to be near daylight, improperly placed windows and glass can result in both excessive energy use and lighting glare issues.
- A firm specializing in lighting design can design a lighting system tailored to building and occupancy requirements, resulting in a better design at a lower first cost than a more generic approach.
- Minimize energy use in non-occupied areas by turning off equipment. Use occupancy sensors for lighting where possible. Areas with significantly different occupancy patterns,

such as the office area in a school, should have their own dedicated mechanical system rather than having to run the main mechanical system.

- Oversized equipment running at partial capacity is typically not efficient. Beware of excessive "safety factor" in the design.
- Consider higher efficiency or alternative cooling systems. While the pay back for higher efficiency air-conditioning equipment in mountain communities may be high, increased efficiency should be examined in warmer climates. Alternative cooling methods such as thermal storage and evaporative cooling may be suitable for schools. Ground source / heat pump systems are also becoming accepted in many parts of the country, although examples of commercial space in Colorado using this technology are limited.

Building Envelope

1. Be wary of designs with over 30% glazing! This can translate to both excessive cost and high energy use while not providing additional day lighting or other benefits.
2. Building entrance doors should have vestibules when the space is more than 3,000 ft2.
3. Entrance doors shall not leak more than 1.0 CFM/ft2 when tested in accordance with ASTM283.

Table 1. Building Envelope

IECC Climate Zones	Zone 11B	Zone 13B	Zone 15	Zone 16	Zone 17
Typical Counties	Baca Bent Crowley Freemont Huerfano Las Animas Otero Prowers Pueblo	Adams Arapahoe Boulder Cheyenne Delta Denver Douglas ElPaso Elbert Gilpin Jefferson Kiowa Kit Carson Larimer Lincoln Logan Mesa Montrose Morgan Phillips Sedgwick Teller Washington Weld Yuma	Dolores Eagle Garfield La Plata Moffat Montezuma Ouray Rio Blanca San Miguel	Alamosa Archuleta Chaffee Conejos Costilla Custer Saguache	Clear Creek Grand Gunnison Hinsdale Jackson Lake Mineral Park Pitkin Rio Grande Routt San Juan Summit
Building Envelope:					
Skylight "U" factor	U= 0.8	0.8	0.6	0.6	0.6
Slab or below grade wall R-value	R= 8	8	8	8	8
Glazing U-factor	U= 0.5	0.5	0.4	0.4	0.4
Glazing Solar Heat Gain Coefficient (minimal overhang)	SHGC= 0.4	0.4	0.5	0.5	0.7
Roof R-value, insulation	R= 30	30 except	30 except	30 except	30 except

between framing	except metal purlin	metal purlin	metal purlin	metal purlin	metal purlin
Roof R-value, continuous insulation	R= 24	24	24	24	24
Floors over unconditioned space or outside – between framing	R= 19	19 wood joist, 25 if metal	25 wood joist, 30 if metal	25 wood joist, 30 if metal	25 wood joist, 30 if metal
Floors over unconditioned space or outside – continuous insulation	R= 14 if over wood, 15 all others	17	23 over metal, 22 all others	23 over metal, 22 all others	23 over metal, 22 all others
Above grade walls – framed or filled cavity	R= 11	13 if metal framed, otherwise 11	13 in frame + 3 continuous if metal, 11 if other	13 in frame + 3 continuous if metal, 11 if other	13 in frame + 3 continuous for wood, 4 for metal
Above grade masonry walls with continuous insulation	R= 5	5	6	6	10

LIGHTING

1. Sample energy budgets for whole buildings and for spaces are given below, along with typical lighting levels.
2. Good lighting design involves much more than the information given here. Consider utilizing a firm specializing in lighting design rather than relying on a generalist-engineering firm.
3. Other than emergency or egress lighting, one manual lighting control shall be provided for each enclosed area. Dual switching or dimming is required to cut lighting levels by 50%. This shall be done in such a manner that a reasonably uniform illumination pattern is maintained.
4. Buildings over 5,000 ft2 shall be equipped with an automatic control to shut off lighting by time of days and on holidays. Switching shall be broken into zones no larger than 25,000 ft2 and include a 2 hour manual zone override.
5. Exit signs shall use no more than 5 watts per side.
6. Building exterior and parking lot lighting shall include an automatic switching or photocell control.

Table 2. Lighting

Building Area Method	Space-Specific	IECC 2003 watts/ft2	***Suggested watts/ft2***	Example Horizontal Illuminance Levels – footcandles
Library		1.3	1.3	
	Reading	1.7	1.17	30
	Stacks	1.7	1.71	30
Office		1.0	1.0	
	Open plan office	1.1	1.06	50
	Office, lighting designed for computer use	1.45	1.06	30
	Conference room	1.1	1.25	30 – 50
	Lobbies	1.3	1.32	10
	Corridors	0.9	0.46	5
School / University		1.2	1.1	
	Classroom	1.4	1.43	50
	Corridors	0.9	0.46	5 (Vertical)

	Active stairs	0.9	0.57	5
	Gymnasium playing area	1.4	1.35	100
Parking garage		0.3	0.2	0.5

Mechanical Systems

1. The code does not specify which system type should be used for a given building. System type can have a significant effect on energy consumption, maintenance and facility operation and should be chosen carefully.
2. Only an overview for central system requirements is given here. Please refer to the code for more details.
3. Equipment over sizing is discouraged. Multiple units should be sequenced to only come on if needed.
4. System controls shall have automatic controls for night setback and equipment shutdown with a two-hour manual override.
5. Economizer cycles shall be provided for air systems over 5 tons (11 tons in zone 13b, see envelope section for areas included in 13b).
6. Ductwork (except ducts within the space served) should be insulated to R 5. Ductwork located outside of the building envelope should be insulated to a minimum of R 8. All ductwork is to be sealed. No generic “duct tape” is permitted.
7. Use VFDs on VAV system fans 25 Hp and larger.
8. Reheat of supply air is limited.
9. Three pipe systems are prohibited. Two pipe systems are heavily restricted.
10. Automatic controls shall be provided to cycle multiple boiler systems. Single boiler systems over 500,000 Btu/h input need a multistage or modulating burner.
11. Hydronic systems over 300,000 Btu/h require either supply water temperature reset or variable flow.
12. Air and hydronic systems will be balanced.
13. The mechanical contractor must provide operating and maintenance manuals.
14. Service (potable) water heating equipment shall have heat traps and temperature controls that will permit set points as low as 90F. Piping shall be insulated, typically with 1” insulation. Please note that there is disagreement concerning actual operation of equipment at this temperature as it may permit the growth of undesirable organisms.

Table 3. Mechanical Systems

Typical Equipment Types		Code Minimum Efficiency	***Suggested Min Efficiency***
Air-cooled air-conditioners or heat pumps, package or split systems, 5 tons or less		10.0 SEER	12 SEER
Rooftop unit with gas heat or air-cooled heat pump unit, > 5 ton but not larger than 11 tons		10.1 EER	11 EER for non-heat pump units
Rooftop unit with gas heat for > 11 and up to 20 tons		9.5 EER	10.8 EER
PTAC, 15,000 Btu/h		9.3 EER	
Gas fired unit heaters		80% Combustion Efficiency	
Hot water boiler < 300,000 Btu/h input		80% AFUE	
Air-cooled water chiller with condenser, 150 tons or less		1.26 kW/ton	< 1.19 kW/ton
Screw chiller, 150 to less than 300 tons at ARI test conditions		0.72 kW/ton	< 0.65 kW/ton

Hot and Chilled water piping insulation, pipe 1.5” and smaller		1” thick	
Hot water piping > 1.5”		2” thick	
Chilled water piping > 1.5”		1 ½” thick	